



Effective Performance Of The Steel And Concrete RC Frame Making

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Abstract: Earthquake strike all of a sudden, strongly and unexpectedly anytime during the day or night. If the earthquake happens in a populated area, you can get many deaths and injuries and extensive damage to property. Although there aren't any guarantees of safety throughout an earthquake, identifying potential hazards in advance and advance intending to save lives and considerably reduce injuries and damage to property. Probably the most frightening and destructive phenomena of the nature is really a severe earth quake and it is terrible consequences. Hence it's mandatory to complete the seismic analysis and style to structural against collapse. It's highly impossible to avoid an earthquake from occurring, however the harm to the structures could be controlled through proper design and detailing. Designing a structure in a way that reducing damage throughout an earthquake helps make the structure quite uneconomical, because the earth quake might or may not exist in its existence some time and is really a rare phenomenon. This research addresses the performance and variation of percentage steel and concrete volume of R.C presented structure in numerous seismic zones and affect on total cost of construction. The current IS code 1893:2002 doesn't provide details about the variation of concrete and number of steel from zone to zone. This research mainly concentrates on the comparison of percentage steel and concrete quantities once the building is made for gravity loads according to IS 456:2000 so when your building is made for earthquake forces in numerous seismic zones according to IS 1893:2002. A 5 storied R.C.C presented structure continues to be analyzed and designed using STAAD ProV8i software program.

Keywords: Earthquake Analysis; Seismic Analysis; Zones;

I. INTRODUCTION

Vibrations from the earth's surface brought on by waves from a supply of disturbances within the earth are referred to as earthquake. Probably the most important earthquake from an engineering perspective is of tectonic origin, that's, individuals connected with massive strains within the crust of the world. Among the theories describing this phenomenon known as elastic rebound theory. It explains the strain soaped up that builds up because of deformation in earth mass, will get released through rupture if this exceed the resilience from the storing materials. The power thus released is propagated by means of wave which impact energy towards the media by which they pass and vibrate the dwelling sitting on the earth's surface. A significant tectonic earthquake is usually preceded by small 'foreshocks' caused either by small rupture or plastic deformation and adopted by 'aftershocks' due towards the fresh rupture or even the readjustments from the fractured mass [1]. A significant shock may end up from the rapture from the rock on the period of 100 to 400 km and many kilometers wide and thick. Small earthquakes can also be brought on by volcanic eruptions, subsidence in mines, blasts, impounding of reservoirs, pumping of oil, etc. They might cause considerable damage within the small areas, but vast areas are shaken only by tectonic movements across active problems. Lately, geologists have

suggested a theory termed plate tectonics. It provides a stylish comprehensive reason behind continent drift and mountain structures. It holds the surface earth includes in regards to a dozen giant plates of rock, 100km thick, which float around the earth's semi molten mantel and propelled by an undetermined pressure. The plates have been in constant motion, where the meet, friction temporarily locks them in position cause stress to develop near their edges. The power released causes earthquakes. Unlike wind or rain storms, earthquake can't be predicted. Conjecture to become helpful needs to be reasonably precise regarding date, time, size and placement like a false alarm might be disastrous. Researches attempts are onto analyze precursor effects to constitute a conjecture. Effective predictions happen to be made only rare causes but there have been false ones. The quantity of data to become collected is vast and costly. Earthquake Terminology: Aftershock: An earthquake of comparable or lesser intensity that follows the primary earthquake. Earthquake: An abrupt sliding or movement of part of the earth's crust, supported and adopted by a number of vibrations. Epicenter: The area around the earth's surface directly over the point around the fault in which the earthquake ruptures started. Once fault slippage begins, it expands across the fault throughout the earthquake and may extend countless miles before stopping. Problems: The

fracture across which displacement has happened throughout an earthquake. The slippage may vary from under one inch to greater than ten years inside a severe earthquake. Magnitude: The quantity of energy released throughout an earthquake that is computed in the amplitude from the seismic waves. A Magnitude of seven. Around the Richter scale signifies a very strong earthquake. Each whole number around the scale represents a rise of approximately 30 occasions more energy released compared to previous whole number represents. Seismic wave: Vibrations that travel out ward in the earthquake fault at speeds of countless miles per second. Although fault slippage directly within structure may cause considerable damage, the vibrations of seismic waves caused the majority of the destruction during earthquake. Ground trembling impact on structure: Inertia forces: Structures are fixed down. As the bottom of a structure moves the superstructure including its contents has a tendency to shake and vibrate in the position of sleep, in an exceedingly irregular manner because of the inertia from the masses [2]. The operation is a lot more complex since the ground moves concurrently in three mutually vertical with respect directions throughout an earthquake. Seismic load: The resultant lateral forces or seismic load is symbolized through the forces F . the pressure F is clearly not the same as the dead, live, snow, wind, and impact loads. The horizontal ground motion action is comparable to the consequence of horizontal pressure functioning on your building, therefore, the term seismic load. As the bottom of the structures moves within a very complicated manner, inertia forces are produced through the mass from the building and it is contents. The earthquake loads are dynamic and impossible to calculate precisely ahead of time, since every earthquake exhibits different characteristics. Factors affecting seismic load: The earthquake zone factor Z is determined by the floor concentration of the earthquake. The need for Z is frequently plotted on maps when it comes to seismic intensity isoclines or maximum acceleration isoclines. Clearly, the greater the intensity or acceleration isoclines. Important parameters in seismic design: The result is that following qualities and parameters are most significant from the purpose of look at the seismic design. Aftereffect of site conditions on building damage: Past earthquakes proven that website condition considerably affects your building damage. Earthquake research has almost always proven the concentration of a surprise is proportional to the kind of soil layers supporting your building. Structures built on solid rock and firm soil frequently fares much better than structures on soft ground. It was dramatically shown within the 1985 Mexico City earthquake, once the damage on soft soils in Mexico City in an

epicenter distance of 400 km, was substantially greater than at closer locations.

II. ANALYSIS OF EARTHQUAKE

Seismic analysis or earthquake analysis is really a subset of structural analysis and it is the calculation from the response of the structure towards the earthquakes [3]. A structure can wave backwards and forwards throughout an earthquake this really is known as the essential mode and it is the cheapest frequency from the structure response. However, structures also provide greater modes of response that are distinctively activated throughout an earthquake. The ductile materials are highly desirable for earthquake for resistant design because earthquake design should fulfill the following two fundamental objectives. To avoid loops of existence, serious injuries and also to prevent structures from collapse and harmful damage under maximum intensity earthquakes. To make sure structures against irreparable damage under moderate to heavy earthquake. The force included in the dwelling alone cannot create and earthquake resistant design, additionally, it requires absorption, meaning structure must have foreseeable ductility in addition to strength. The damping characteristics of the structure possess a major impact on its reaction to ground motion because little bit of damping considerably cuts down on the maximum deflection to resonant response from the structure. Indian Standard Code (IS 1893-2002) recommends the style of earthquake resistant structure in 2 alternate approaches the following: Static approach: Seismic coefficient method. Dynamic approach: Response spectrum method, Time history method.

III. METHODOLOGY

Seismic analysis of the structures is carried out on the basis of lateral force assumed to act along with the gravity loads. The base shear which is the total horizontal force on the structure is calculated on the basis of structure mass and fundamental period of vibration and corresponding mode of shape. The base shear is distributed along the height of the structure in terms of lateral forces according to coda provisions (Kazuhiro, 1987). In this study, a five (G+4) storied RC building has been analyzed using the equivalent static method in STAAD-Pro V8i. The plan and elevation of the building taken for analysis. Three Dimensional view of the whole structure is shown is showing the structure subjecting to the vertical loading are showing the structure subjected to loading of earthquake in “+X” and “+Z” directions [4]. In the earthquake analysis along with earthquake loads, vertical loads are also applied. For the earthquake analysis, IS 1893-2002 code was used .The total design seismic base shear (V_{ibe}) along any

principal direction shall be determined by multiplying the design horizontal acceleration in the considered direction of vibration (A_h) and the seismic weight of the building. The Design base shear (V_b) = $A_h \times W$. A_h = design horizontal acceleration in the considered direction of vibration = $(Z/2) \times (I/R) \times (S_a/g)$, W = total seismic value of the building. The design base shear (V_b) computed shall be distributed along the height of the building as per the following expression (BIS1893: 2000)

$$Q_i = V_b \times (W_i \times h_i^2 / \sum W_i \times h_i^2)$$

Where, Q_i is the design lateral forces at floor i , W_i is the seismic weights of the floor i , and h_i is the height of the floor i , measured from base. The lateral force on each storey is again distributed based on the deflection and stiffness of the frame. The total lateral load in proportion to the stiffness of each frame in all the four zones. Earthquake load was considered in +X, -X, +Z and -Z directions. Thus a total of 13 load combinations are taken for analysis. Since large amount of data is difficult to handle manually (M.H. Arslan, 2007), all the load combinations are analyzed using software STAAD Pro. All the load combinations are mentioned above [5].

IV. RESULTS

The variation of support reactions at each location of the columns and the percentage difference in different seismic zones with respect to gravity loads is represented in the in Table 2 and Fig.19. It is observed that in edge columns, variations are 17.72, 28.35, 42.53, and 63.7% between gravity load to seismic zones II, III, IV and V respectively. In exterior columns, the variations are 11.59, 18.54, 27.81, and 41.71% between gravity load to seismic zones II, III, IV and V respectively. The variation is very small in interior columns.

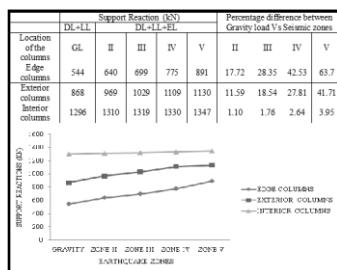


Fig.2. Variation of support reactions in different seismic zones

V. CONCLUSION

The variation of support reactions in exterior posts growing from 11.59% to 41.71% as well as in edge posts growing from 17.72% to 63.7% in seismic

Zones II to V. Nevertheless the variations of support reactions are extremely small in interior posts. The level of concrete in exterior and edge column footings is growing in seismic zones III, IV and V because of increase of support reactions using the aftereffect of lateral forces. Nevertheless the variation is extremely small in interior column footings. It's observed the weight of steel in edge column footings between gravity loads to zone II, III, IV and V varies as , 23.6, 47.9 and 98.nine percent correspondingly. It's observed the weight of steel in exterior column footings between gravity loads to zone II, III, IV and V varies as 38.1, 54.8, 70.7 and 91.04 % correspondingly. It's observed the weight of steel in interior column footings between gravity loads to zone II, III, IV and V varies as 22.07, 42.4, 56.03, and 67.9% correspondingly. The proportion variation of steel in edge, exterior and interior posts differs from .8-3%, .8-3.9% and 1.1-3.7% between gravity loads to seismic zone V correspondingly. The variation of number of steel at support sections in exterior beams is .54% to at least one.23% as well as in internal beams is .78% to at least one.4%. Within the exterior and internal beams, the proportion of bottom middle reinforcement is nearly same for earthquake and non earthquake designs. Percentage variation of total concrete quantity for the entire structure, between gravity load and seismic zones II, III, IV and V varies as 1.4, 1.94, 2.69 and three.8 correspondingly. Percentage variation of total steel quantity for the entire structure, between gravity load and seismic zones II, III, IV and V varies as 12.96, 18.35, 41.39 and 89.05 correspondingly. It's observed the percentage variation of cost for the entire structure, between gravity load and seismic zones II, III, IV and V varies as 2.53, 3.33, 7.17 and 14.59 correspondingly. The proportion increase of steel for the entire structure with ductile detailing when compared with non ductile detailing is 16%. The proportion rise in cost for the entire structure with ductile detailing when compared with non ductile detailing is 4.06%

VI. REFERENCE

- [1] Design Aids for Reinforced concrete to IS: 456-1978(SP-16), Bureau of Indian standards, New Delhi.
- [2] Durgesh C. Rai (2005) "The guidelines for seismic evaluation and strengthening of buildings" Department of Civil Engineering, IIT Kanpur.
- [3] H.J. Shah and Sudhir K. Jain (2008), "Final Report: A -Earthquake Codes IITK-GSDMA Project on Building Codes (Design Example of a Six Storey Building)", IITK-GSDMA-EQ26-V3.0

- [4] H. M. Salem, A. K. El-Fouly, H.S. Tagel-Din (2011), “Toward an Economic Design of Reinforced Concrete Structures against Collapse”, Engineering Structures, Elsevier, 33, 3341-3350.
- [5] K.Krishna murthy, Veejay consultants, Hyderabad “Earthquake Resistance Design of Residential Buildings”, CREDAI Visakhapatnam.

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